

New Energy Standards for HVAC Change-Outs

Going Beyond Duct Testing

by Douglas Beaman

This article is published in the January 2009 issue of Indoor Comfort News. This is an overview of the regulations, it is not intended to provide sufficient detail for contractors or HERS raters. Watch for additional articles and training in your area to fully understand the requirements.

The new California Energy Standards are just around the corner; they take effect August 1, 2009. Since 2005, the Energy Standards have required Duct Sealing and Testing when you change-out an HVAC system. The new Standards require (in some climate zones):

- **Duct Sealing and Testing**
- **Refrigerant Charge**
- **Air Flow Measurement**
- **Fan Watt Draw.**

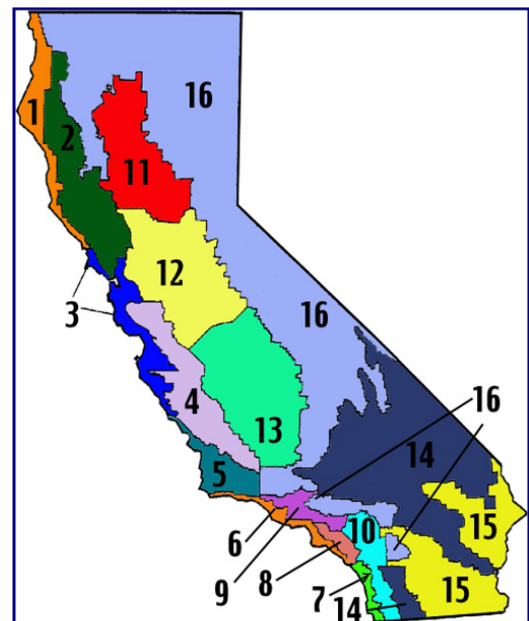
Yes, in climate zones 10 - 15, you have to do all FOUR.

Climate Zone	Duct Seal & Test	Refrigerant Measurement	Airflow Measurement	Fan Watt Draw
1	Not Required			
2	Required		Not Required	
3-7	Not Required			
8	Not Required	Required	Not Required	
9	Required		Not Required	
10-15	Required			
16	Required	Not Required		

Climate Zones

This map gives you a general idea of the Climate Zone's (CLZ). To determine the CLZ's with more precision, refer to the website listed below. This web site lists every California city and its CLZ. The web site also uses Google maps to create an overlay of the CLZ's making it easy to pinpoint any location in California.

energy.ca.gov/maps/building_climate_zones.html



About the Author

Douglas Beaman is the owner of Douglas Beaman Associates, a Modesto based energy consulting firm. Doug has 30 years of experience working with contractors, owners, and designers. He has taught thousands of contractors about duct testing, duct design, and the California Energy Standards.

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Duct Sealing and Testing

The duct sealing and testing rules that began in 2005 remain in effect. Both the allowable leakage rates and the Climate Zones remain the same.

There is one important change: Contractors were allowed, in some cases, to avoid duct sealing and testing by installing higher efficiency equipment. This exception has been eliminated. Installing higher efficiency equipment may NOT be used instead of duct sealing and testing.

Refrigerant Charge Measurement (Cooling Systems Only)

In Climate Zones 2 and 8-15, when a new or replacement split system air conditioner or heat pump is installed, the **REFRIGERANT CHARGE MUST BE MEASURED AND THIRD PARTY VERIFIED**. The Refrigerant Charge Measurement is required if:

- The whole system is installed OR
- An outdoor condensing unit is installed OR
- An indoor coil is installed.

Simple enough: When a new A/C system is installed, the installing contractor performs a refrigerant charge measurement and has a HERS rater verify. This applies to either replacing an existing unit or installing a new system. The contractor shows proof of the refrigerant charge measurement by completing the CEC required forms.

But there is more. One of the concerns of HVAC contractors is having a HERS rater attach gauges to the system after they leave: so the code requires a non-intrusive means of verification. The installing contractor, has to install 1) temperature measurement access holes and 2) saturation temperature measurement sensors. This allow the HERS rater to verify system performance without attaching gauges to the system.

Temperature measurement access holes are 5/16” holes that the contractor drills, one in the supply plenum and one in the return plenum. Exact locations are specified: watch for more detailed training.

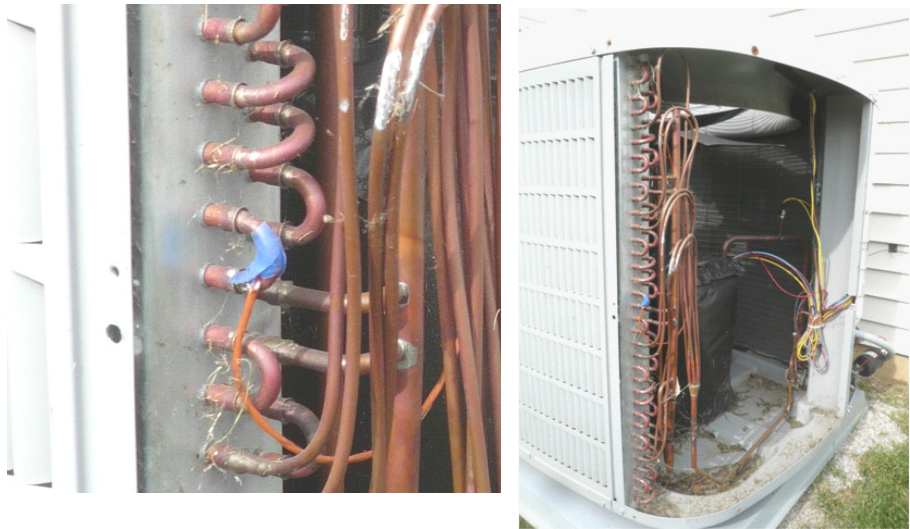
Saturation temperature measurement sensors are Type K thermocouples permanently attached to the evaporator coil and the condenser coil. The plug on the end of the thermocouple is plugged into a handheld digital thermometer to read the temperature.

Charge Indicator Display

If the contractor installs a “Charge Indicator Display” he does not have to drill the access holes or install the thermocouples. At present time, there are no commercially available Charge Indicator Displays. When they become commercially available, this will be an alternative but the installing contractor will still need to perform the refrigerant charge measurement.



The Type K thermocouple must be precisely attached to the indoor coil and to the outdoor unit. The photos show an example of the thermocouple attached to the outdoor unit. Again, watch for more details and trainings in your area.



The HERS rater will use their handheld digital thermometer to take eight temperature readings at the system. (There are explicit guidelines on outside air temperatures, operating the system prior to taking the readings and such.) The temperature readings are then entered into a worksheet to determine if the refrigerant charge is within standards for the system.

Airflow

In CLZ's 10 – 15, when split system air handlers (Gas FAU's or heat pump) are installed, the air handler must deliver at least 350 cfm/ton in cooling mode. We all "know" that typical systems deliver 400 cfm/ton of airflow, so 350 cfm/ton should be an easy target. If you think this is a true statement, please immediately start measuring airflow in every system that you work on. Low airflow is a very, very common problem. Systems seldom deliver 400 cfm/ton, and many times not even 350 cfm/ton: there is just too much resistance in the system.

Measure total system airflow at the return grill(s). There are three acceptable methods to measure the airflow.

1. Flow capture hood
2. Flow Grid Device
3. Plenum pressure matching procedure – don't ask; use one of the other two methods.

If the system does not deliver 350 cfm/ton, there are many solutions. Two potential solutions are:

- The contractor can install an air handler with an ECM motor where there is a "switch" to select the desired airflow. Of course, ECM motors are more costly. Talk to your supply house.



Scott Johnson Using a Flow Capture Hood

- Another solution is to decrease the resistance within the existing duct system. One method to reduce the system resistance is to enlarge the return grill and duct or install a second return grill and duct. This solution might achieve the required airflow and would certainly improve system performance and comfort in the home.

Regardless of how you achieve the 350 cfm/ton of airflow; the contractor measures airflow and it must be verified by a HERS rater.

Fan Watt Draw

In CLZ’s 10 – 15, the indoor air handler must not use more than 0.58 watts per CFM. Determining if the installed system meets this criteria requires three steps.

1. Use a flow hood or flow grid to measure the airflow.

2. Using the *Fan Watt Calculation Worksheet*, multiply your measured airflow times 0.58. In our example, we use 975 cfm. In this example, the maximum wattage that the indoor fan may draw is 566 watts.

Fan Watt Calculation Worksheet			
975	X	0.58	=
Measured System Airflow			=
566			
			Maximum Allowed Watt
550			
			Measured Fan Watts
Measured Fan Watts Must be Equal to or Less than Maximum Allowed Watts			
Example Fan Watt Draw Calculation			

3. Measure the actual fan watt draw and compare it to the maximum allowed.

The photo shows a plug-in watt meter measuring 550 watts, thus this example system meets the fan watt draw standard.

The easiest way to measure the fan wattage is a plug-in watt meter (two brands are listed at the end of the article). You plug the air handler fan into the watt meter, plug the watt meter into a 110 outlet and read the total fan watt draw of the air handler.

If the indoor fan is hard wired, contractors can use a clamp type amp meter. A note of caution when using an amp meter to measure wattage. Although it is technically accurate to calculate wattage by multiplying ampere times voltage, in practice the results will vary. The challenge is that the voltage of a 110 outlet varies between 110 and 120 volts distorting your results.



watts up? Brand Watt Meter

Sampling

The installing contractor MUST measure, test and document every job (or hire someone to perform the tasks). If the contractor does not have the necessary equipment, a HERS rater can perform the test for them. But sampling is not allowed, the HERS rater may not make corrections, and the contractor is still responsible to ensure that all measures are within the guidelines.

If the contractor has tested and documented each job, it is acceptable for the HERS rater to randomly sample completed jobs instead of testing every job. If a tested job fails, it must be corrected and the rater must test another house. If the second house fails, all jobs in the sample group must be tested.

The new standards include revised sampling rules. Without reviewing all of the sampling changes, two points are important. The HERS rater must enter every job into the HERS registry not just the tested jobs, so there will likely be a rater fee for every job. The HERS provider (CHEERS / CalCerts) is required to perform Quality Assurance testing on both rater tested jobs and sampled jobs.

Conclusion

The State of California is serious about improving the quality and efficiency of HVAC systems. The new energy standards are a very serious step in that direction.

Will this add cost to your jobs? **Absolutely!**

Should we be installing systems with tight ducts, correct refrigerant charge, and good airflow? **Absolutely!**

Although many may not like the regulations, the intention of the regulations is the same that our intention should be: Quality HVAC systems that provide energy efficiency and comfort for our customers.

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Duct Tester	
The Energy Conservatory	Retrotec Energy Innovations, Ltd.
Phone (612) 827-1117	Phone (604) 732-0142
energyconservatory.com	retrotec.com

Flow Hood	
Accubalance Air Capture Hood	ALNOR® Balancing Tool
(651) 490-2811 or (800) 8272811	(651) 490-2811 or (800) 827-2811
tsi.com	tsi.com
Check your local supply houses	

Flow Grid	
The Energy Conservatory	
Phone (612) 827-1117	
energyconservatory.com	

Digital Multi Channel Thermometers	
UEI	Testo, Inc.
(503) 644-8723 or (800) 547-5740	(862) 354-5001 or (800)227-0729 ext. 123
ueitest.com	testo.com
Check your local supply houses	

Electric Usage Meters	
watts up?	Kill-A-Watt
Phone 303-282-6410 or (877) WATTS01	Phone (212) 346-7979
wattsupmeters.com	p3international.com
Local Electronics Store such as Fry's	

Fan Watt Calculation Worksheet

_____	X	0.58	=	_____
Measured System Airflow				Maximum Allowed Watt

Measured Fan Watts _____

Measured Fan Watts Must be Equal to or Less than Maximum Allowed Watts